

DESIGN AND IMPLEMENTATION OF WAREHOUSE MANAGEMENT IMPROVEMENT STRATEGY USING BARCODE SYSTEMS APPROACH AT PT LATINUSA TBK

Pengky Frusman¹
Dermawan Wibisono²

¹School of Business and Management (SBM), Institut Teknologi Bandung (ITB), Indonesia

²Visiting Professor at Universiti Utara Malaysia (UUM), Malaysia

Abstract

The availability of good warehouse management is one of important aspect should be concerned in a company, especially for a company which engaged in manufacturing. The basic activities that are managed by warehouse management includes receiving goods from production section, transferring them from one location to another within same warehouse or another, delivering to customers include picking and loading activities, and physical verification activities compare to the recorded data in the system.

PT Latinusa Tbk as the only one company in Indonesia that produces tinplate, raw material for cans, faced several warehouse problems, such as missed products shipping to customers, long time execution to look for goods in warehouse due to position of goods were not updated, any changes in goods' specifications were not followed by reattachment process of goods' tickets, inaccurate data recording, and update of goods position was not carried out regularly. This evidence consequently decreasing low warehouse management image in which it will give effect on customers' trust for the company.

This paper proposed a suggestion to PT Latinusa Tbk to improve quality of warehouse management system for implementing information technology approach namely Barcode System. The proposed solution includes: 1. Design of process warehouse management activities involve stock management, record keeping, delivery activity to customers, 2. Design of barcode format that will be used through optimization of feature from two-dimensional barcode format, 3. Design of systems to increase barcode solution with existing ERP System with necessity of estimated costs from implementation and proposed implementation time schedule. To provide additional insight relates to integrated barcode system solutions for the warehouse, it conducted a comparison in performances of implemented integrated barcode system in PT Frisian Flag and PT Krakatau Steel Tbk.

Research shows that implementation of barcode solution can affect positively the quality of the warehouse management both in terms of time savings, loss of income due to customers' claims, data quality in system, personnel's cost, as well as company image in providing high quality delivery services to customers.

Keyword : warehouse management, barcode system, goods delivery, claim, information technology.

I. Introduction

PT Pelat Timah Nusantara, Tbk. or PT Latinusa, Tbk. is the first and the only one company in Indonesia that produces tinplate with internationally recognized quality. It was established on 19 August 1982, under the Notary Deed of Imas Fatimah, SH, No.45, with majority of shareholders are presently Japan Consortium with 55% shares, consist of Nippon Steel & Sumitomo Metal Corporation 35.0%, Mitsui & Co. Ltd. 10.0%, Nippon Steel Trading Co. Ltd. 5.0%, and Metal One Corporation 5.0%. The remaining 45% shares are owned by PT Krakatau Steel (Persero), Tbk. 20.1%, PT Baruna Inti Lestari 4.9%, and Public 20.0% (Company

Profiles of PT Pelat Timah Nusantara Tbk, 2013).

Tinplate is a raw material such as packing tins of milk cans, paint cans, batteries, and other packaging materials. Illustration of tinplate usage is described as follows:



Figure 1. Tinplate usage

Main raw material is Tin Mill Black Plate (TMBP) that will be coated by tin using electrolytic process with final result is Tinplate that can be used for packing tins of milk cans,

paint cans, batteries, and other packaging materials. Tinplate is delivered into 2 types of forms that are coil and sheet. As a manufacturer company, Latinusa's cover all business activities starts from sales up to customer service management includes sales, logistic, procurement, production process, quality management, warehouse management, distribution and customer service management.

This paper would like to concern on improvement of performance of inventory department below PPIC division, especially at finish good warehouse because of critical area before the products are being delivered to customer.

From the data of customer claim in Dec 2011 – Jan 2013, it could be seen that defect and underweight issues are the most cause of the customer's claim on that period (Customer Claim Report Summary of PT Pelat Timah Nusantara Tbk, 2013).

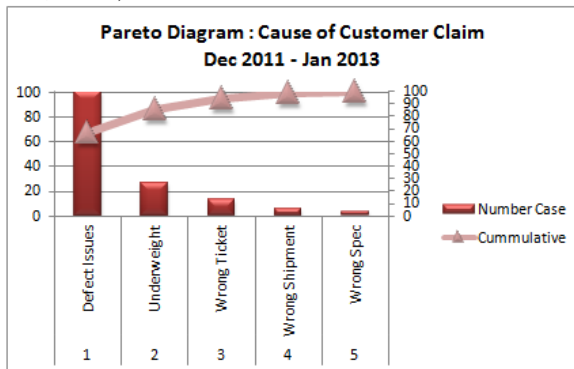


Figure 2. Cause of Customer Claims

On the other hand, wrong specification was the least cause of customer claim. Defect issues and wrong specification are issues relates to the coating process and machine. Otherwise underweight issue is the issue relates to scale device. In this paper, concern will focus on inventory department issues that are wrong ticket and wrong shipment.

1. Wrong Ticket

Wrong ticket issue means the information that shows on product ticket is not same with physical product. This case comes due to specification changes without reprinting the product ticket.

2. Wrong Shipment

Wrong shipment issue means the product that has been delivered to customer did not fit with customer's order specification. Inventory department missed to pickup the product to customer.

As a reliable and trustworthy producer of the high quality tinplates, it is important for PT Latinusa Tbk to not only maintaining the product quality but also the quality of the delivery service.

II. Business Issue Exploration

A. Conceptual Framework

The paper is composed based on the conceptual framework such depicted in the Figure 2 below.

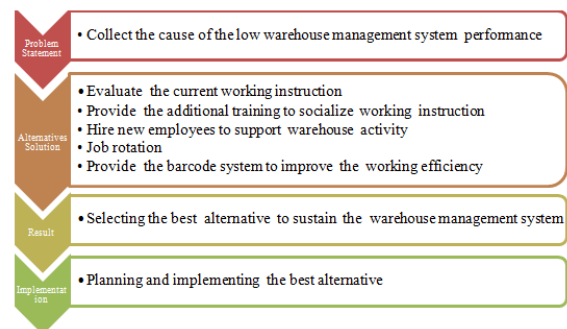


Figure 3. Conceptual Framework

The collecting cause of low performance of warehouse management system is carried out since it is a root cause of problem in the company. Kappauf, Lauterbach and Koch (2012) define warehouse management concepts as “Originally, warehouse systems were pure stock management systems, whose goal it was to maintain quantities and locations within a warehouse and their relation to one another. In addition to the elementary functions of warehouse management, such as quantity and location management, conveyance control and planning, warehouse management also includes comprehensive means and methods for supervising system conditions (with software and automation technology) and a selection of business and optimization strategies”.

There are five alternative solutions will be investigated that are evaluating current working instruction, providing additional training to socialize working instruction, hiring new employees to support warehouse activities, job rotation, and providing barcode systems to improve working efficiency. Analyzing of five alternatives is conducted to select the best alternative to improve and sustain the warehouse management system.

B. Research Methodology

The data are obtained from internal data processing, external data processing in relation to the things needed to support and complete internal data, literature study, observations and interviews to people that has responsibility for daily operation in warehouse management. To complete the understanding of implementation technology in warehouse management, a study case to the other companies was conducted.

C. Root Cause Analysis

Fishbone diagram was used as tool to analyze low performance of warehouse management system issue as follows:

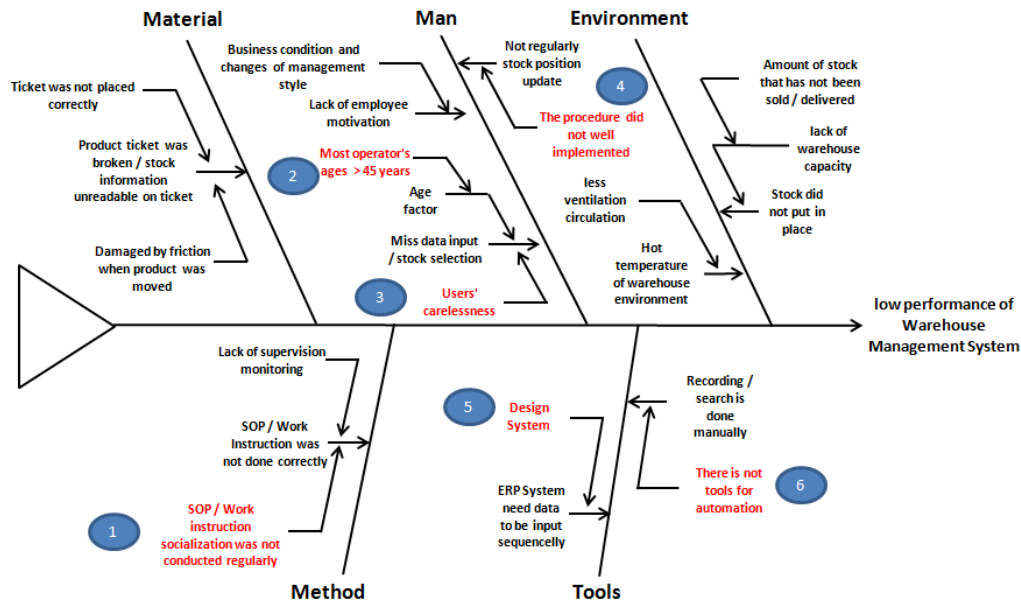


Figure 4. Fishbone Diagram

In the fishbone diagram, several items are highlighted:

- SOP / Work instruction socialization was not conducted regularly**
The absence of regular socialization can affect how deep a working instruction was followed by the employees.
- Most operators' ages > 45 years**
The age factor can affect on how someone can complete his job with or without mistake. Field activities like shipping activities need energy and concentration to be completed since the lack of energy and concentration can lead to forgetfulness or negligence.
- Users' carelessness**
To complete the job, the employees need to pay full attention for the SOP/Work Instruction. Users' carelessness can lead the SOP/Work Instruction to be not completely done.
- The procedure did not well implemented**
Each department has own SOP/Work Instruction as standard for the employees to complete the jobs. Sometimes, the procedure is not completely processed not only due to

the procedure socialization but also inability of the procedure to handle actual working activity. Regular review is needed to ensure the procedure is able to meet the actual working condition.

5. Design System

Latinusa has implemented SAP System as the ERP tools to support their business activity since 2011. SAP is known as the integrated ERP system, each process of SAP module is connected to each others. One process' mistake can impact the others, and the incomplete process will make the other process could not be processed. Discipline and accuracy is the main key for the data input in SAP System.

6. There is no tools for automation

Automation tool can improve the quality of the data input process and the system checking. Without the automation tool, the user needs to use paperwork to complete their job and the manual check for validation.

Based on some of root cause items above, the author group those items into three categories of root cause:

- Working instruction issues
- Human Resource issues
- Information Technology issues

III. Business Solution

A. Business Solution Alternatives

There are some alternative solutions could be offered to PT Latinusa Tbk to improve the warehouse management as follows:

1. Working instruction issues
 - Evaluate the current working instruction (WI).
 - Provide the additional training to socialize working instruction.
2. Human Resource issues
 - Hire new employees to support the warehouse activity.
 - Conduct a job rotation to keep the employee away from the complacency and boredom of their routine.
3. Information Technology issues
 - Provide the barcode system to improve working efficiency and to reduce human error.

B. Business Solution Analysis

To select the best solution to be proposed to improve the warehouse management at PT Latinusa Tbk, the analysis of each alternative solution is needed as follows:

1. Evaluate current working instruction (WI): PT Latinusa Tbk has implemented ISO 9001 and has a regular program to evaluate the implementation of SOP/Working Instruction on each division
2. Provide additional training to socialize working instruction: Each of Division Manager has responsibility to monitor and evaluate execution of each SOP/Working Instruction in his/her division. They can conduct additional training to socialize working instruction
3. Hire new employees to support warehouse activity: current employees who support warehouse activity have met organizational structure design. Most of current employees' age is more than 45 years old. Hiring new employee can be proposed to replace those who will have their retirement within 1-1.5 year

4. Conduct a job rotation to keep the employee away from the complacency and boredom of their routine : Job rotation is a kind of a regular activity that usually conducted in every division. Each of Division Manager can propose a job rotation to the HCM Division
5. Provide barcode system to improve working efficiency and to reduce human error: Barcode System can provide the real time data execution and reduce the kind of human's error like miss typing or miss batch selection on screen.

This paper is not concerning on alternative solutions related to the working instruction and human resources. The solution that is proposed to improve warehouse management at PT Latinusa Tbk is related to information technology by using barcode system approach that directly connects with current enterprise resource planning (ERP) system. In the presentation of *Efficiency in Supply Chain Execution*, Dr.Christoph Lebmollmann offers the benefit of warehouse management with Radio Frequency (RF) Scanner like Easy handling and overall visibility, Speeding up on Supply Chain Management, Independence and Security, Reduced Total Cost of Ownership (TCO) and quick Return of Investment (ROI).

C. Business Process Design

Mainly, scope of barcode system implementation will cover 2 main areas:

1. Improvement of storage management at Tinplate Warehouse, it consist some activities:
 - Moving tinplate from production area into warehouse area.
 - Moving tinplate among bin in warehouse area.
 - Tinplate stock take.
2. Improvement of shipment activity at tinplate warehouse consists several activities, includes:
 - Shipping tinplate to customers.
 - Relocate tinplate to another Latinusa's warehouse.

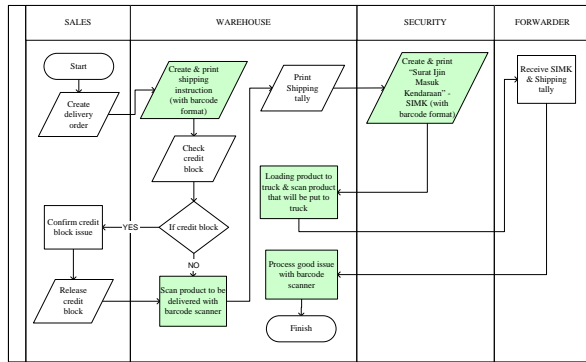


Figure 5. Proposed flow process of shipping Tinplate to the customers

The benefit of proposed business process design:

- It can avoid probability of user miss input data into paper work.
- It can avoid probability of user miss update data into ERP System.
- It can avoid probability of user miss select batch that does not match with delivery order specification.
- It can avoid probability wrong ticket specification will be delivered to customers.
- It can avoid probability of user miss pick up batch to truck.
- It can reduce time consumption of shipment activity and improve data accuracy.

D. Systems and Technical Design

Systems design and technology that will be used for barcode implementation, includes:

1. Barcode format design

In this paper, it is proposed to use two-dimensional (2D) barcode because some of product specifications will be put into barcode matrix. The type of two-dimension (2D) barcode that will be used is QR-Code. “*Bar codes are linear one-dimensional codes and can only hold up to 20 numerical digits, whereas QR codes are two-dimensional (2D) matrix barcodes that can hold 7,089 numeric characters and 4,296 alphanumeric characters, and 1,817 kanji characters of information*” (A. Sankara Narayanan, 2012)

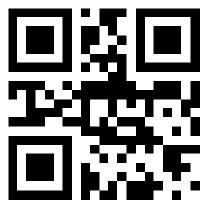


Figure 6. QR Code

QR-Code barcode will be used to keep information on the following items:

- Shipping instruction document, information keep in QR-Code: Delivery order document number.
- *Surat Ijin Masuk Kendaraan* (SIMK), information keep in QR-Code: truck number, name of driver, driver license, SIMK document number, enter date, and type of truck.
- Product ticket of tinplate, information keep in QR-Code is related with product specification for example: batch number, material code, weight, thickness, temper, grade, etc.
- Bin information.

2. Barcode process design

Design of barcode system workflow and how does it work can be seen as follows:

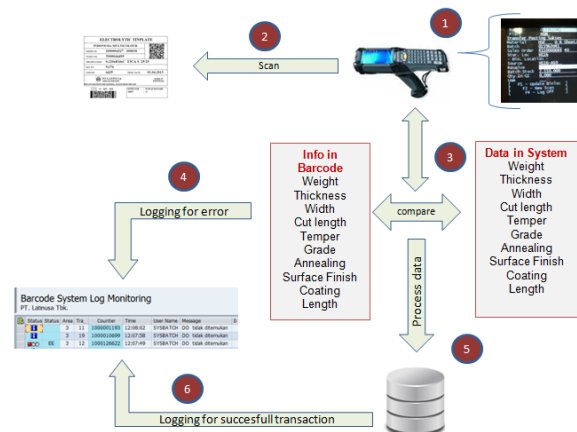


Figure 7. Flow of Design

1. Users need to select menu on the barcode scanner correspond to the activity that will be processed, for example: shipment menu.
2. Users need to scan barcode on product ticket and other barcode like barcode on shipping instruction, SIMK, or bin information.
3. Barcode program will compare product specification stored in product ticket with product specification stored in the database. If there is any difference found between product specification on product ticket and data in database, transaction cannot be processed before user fixes the problem. This function is aimed to avoid condition when there is a product specification change in the system due to

any reasons and user forgets to re-print the ticket.

4. If there is any difference found between product specification on product ticket and data in the database, it will be informed at user's screen and log the error into the database.
 5. If there is no differences found between product specification on product ticket and data in the database, transaction will be processed and corresponded with selected menu.
 6. Every successful transaction will be put into log system
3. Supporting components

To implement barcode system for warehouse management improvement, there are several components should be prepared. As research has been conducted by Lebow (1998) states that there are some design consideration in mind like system architecture, product labeling, barcode standards, scanner, and system operations.

- Information of bin number
Bin number information will be put in 2 positions: the warehouse floor and the warehouse wall. Bin installation design for warehouse floor can be seen as follows:

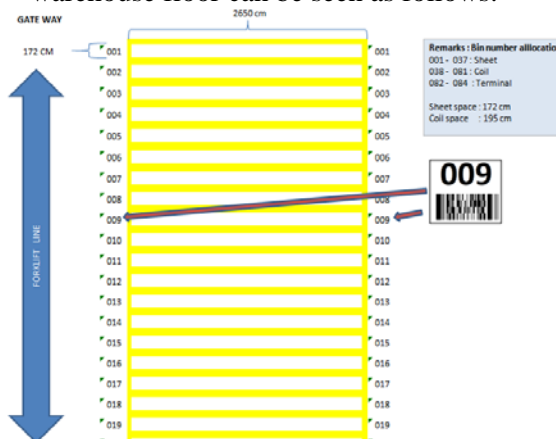


Figure 8. Illustration of bin number mapping on the warehouse floor

- Material for Ticket
Material for the ticket is using Vinyl Yupo material that usually used as the barcode printing material.
- Barcode Printer
The barcode printer is needed to print a barcode on a ticket.
- Barcode Scanner

Barcode scanner is the main component for barcode system configuration and is used to transfer information that is kept in the barcode data and send it directly to ERP System. Barcode scanner is a kind of Personal Digital Assistant (PDA) device that can connect to ERP System and execute ERP Program directly on the device.



Figure 9. Barcode Scanner

The illustration of how it works can be seen as follows:

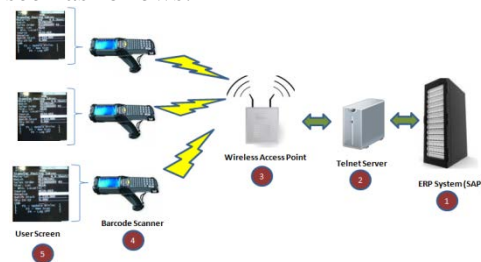


Figure 10. Illustration of how barcode scanner works

1. Main system of application is ERP Systems. Latinusa has implemented SAP Systems since 2011. The application of barcode was developed in SAP Systems.
 2. Telnet server is used to convert graphical screen from SAP into the character based format.
 3. Wireless access point is network components that is used as the gateway to communicate between barcode scanner with telnet server.
 4. Barcode scanner will communicate with the telnet server through wireless network.
 5. The user will see the screen that have been converted into the character based format.
- WirelessNetwork Infrastructure
The integration between the barcode scanner with ERP system must be supported by the wireless network infrastructure.

- **SAP Barcode Program**
The integration between the barcode data transaction and ERP system needs to create a program as the interface for the data transaction. The program is created by using SAP Programming (ABAP code). All of the automation process will be processed by barcode program.

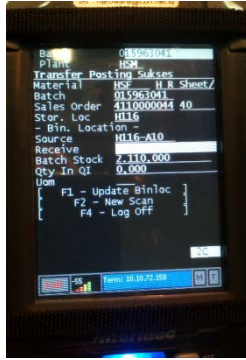


Figure 11. Sample of program screen of barcode program

- **System Logging**
To monitor barcode transaction and data logging, user can monitor directly on SAP System. Barcode logging system can be seen as follows:

Figure 12. Barcode Log System

E. Conclusion

By implementation of barcode system for warehouse management, it can provide some benefits either for the administration purpose or the systems control for product delivery. Research has been conducted by Connolly (2008) states that labeling technologies facilitate automatic product identification, rugged handled computers with wireless communication give real-time capability and integrate stock control into wider software system for efficient resource management. The comparison between condition before and after barcode system implementation can be seen in the table 1 as below:

Table1. Comparison Before and After Implementation

Parameter	Before
Time	More time is needed for user to update stock information into system.
Miss data input	There are many possibilities for missed data input either on typing process or on paperwork writing.
Labor Costs	More personnel are needed to support shipment activity. It is not just related with physical activity but also data entry activity.
Revenue loss	Some claims are related to wrong product shipment. It is caused by forgetfulness of PIC to double check activity. It can affect the revenue loss for the company.
Data checking	Data checking that related to product specification, and product delivery is needed to be checked manually by user.
Corporate Image	Some claims relates to missed product shipment can affect corporate image. Corporate is highly committed to on time delivery and to meet order specification with high quality products.
Parameter	After
Time	Stock information can be updated in real-time condition.
Miss data input	Data will be passed through barcode scanner, there is no possibilities for missed data input.
Labor Costs	It can reduce personnel to support shipment activity by improving some business processes and data entry activity.
Revenue loss	Case of missed product shipment should not occur again because system will automatically check product shipment specification with delivery order data.
Data checking	System will automatically conduct data checking when user is doing some activities with barcode scanner.
Corporate Image	By using barcode system, claims related to missed product shipment could be avoided.

IV Business Solution

A. Implementation Plan

In order to deliver barcode implementation solution to PT Latinusa Tbk, several actions should be prepared in implementation plan that use SAP Implementation methodology . As mentioned in SAP Guidance portal (2013),

SAP Implementation methodology is divided into several phases as follows:

1. **Project Preparation:** the project team defines project goals, a high-level scope, and a project plan. Custom program development and system configuration will be delivered by SAP Consultant from third party.
2. **Blueprint:** Solution and technical designs are documented in business blueprint. Current business process of warehouse activity will be discussed and proposed business process and system design will be created.
3. **Realization:** In realization phase, baseline configuration, which represents core of business process settings, is performed, tested, and confirmed. This is followed with a series of configuration and development cycles, to implement entire end-to-end solution.
4. **Final Preparation:** In final preparation phase, all systems are known to have function correctly according to approved integration test. Moreover, user training/socialization will be taken place.
5. **Go-Live Support:** purpose of go-live support phase is to move from a preproduction environment to a live production operation.
6. **Run:** primary goal of the run phase is to ensure operability of the solution. Operability is the ability to maintain IT solutions in a functioning and operating condition, guaranteeing systems availability and required performance levels to support warehouse operations.

B. Implementation Schedule

All of phases are planned to be completed within 3 months of the project exclude 1 month support. Detail of that implementation schedule can be seen in the table 2 as below:

Table 2. Implementation schedule

No	Item	I				II				III				IV			
1	Project Preparation																
	Project Administration																
	Hardware Procurement																
2	Blue Print																
	Technical Design Planning																
	Business Blue Print Design																
	Training & Installation Plan																
3	Realization																
	Function Specification Design																
	Program Development																
	Hardware, bin information installation & Testing																
	Program Testing & Simulation																
	User Acceptance Test																
4	Final Preparation																
	Master Data Update																
	Print New Barcode Ticket for Existing Stock																
	End User Training																
5	Go Live – Support																
	Go Live																
	Support from Consultant																

C. Recommendation for further research

The present research provides technology solution to improve the warehouse management performance. It focus on how technology could reduce manual activities like data input, data checking, data update in related with warehouse management. Further research could be proposed to analyze about other issues as follows:

1. The availability of warehouse KPI (Key Performance Indicator) to help management to evaluate warehouse activities performance. Even though, PT Latinusa Tbk is not a logistic company, the availability of Warehouse KPI can help management to understand and control performance in managing warehouse for daily operation. Some of warehouse KPI that could be proposed to be analyzed are inventory turn over, case picking productivity, and customer case filling on time. As Schmidt Thorsten (2006) states in *Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems Book* that key performance indicators are used to give a quick overview over optimal costs and performances and to evaluate the different variants.
2. Propose total reward and punishment strategy to link between employees Incentive Program with warehouse management performance. The availability of total reward and punishment strategy can help the management to control warehouse management performance.

Volume 3 issue 7. Quoted on 15 Feb 2013 from http://www.ijcst.org/Volume3/Issue7/p13_3_7.pdf

Schmidt, Thorsten, 2006, *Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems*, Springer.

SAP Guidance, 2013, *ASAP Methodology for Implementation*, Quoted on 5 March 2013 from <http://www.sdn.sap.com/irj/sdn/go/portal/prtroot/com.sap.km.cm.docs/lw/asap%20methodology/asap%20methodology%20for%20implementation/Index.htm>.

Lebow, Jeff, 1998, Planning and implementing a successful barcode system: A project primer, Quoted on 15 Feb 2013 from <http://search.proquest.com/docview/231437115/fulltextPDF/EBB1CDCA765E4E6FPQ/89?accountid=31562>.

Christine, Connolly, 2008, Warehouse management technologies, Quoted on 16 Feb 2013 from <http://search.proquest.com/docview/226852448/fulltextPDF/A108BFE673784AEFPQ/53?accountid=31562>.

REFERENCES

Company Profiles of PT Pelat Timah Nusantara Tbk, 2013.

Customer Claim Report Summary of PT Pelat Timah Nusantara Tbk, 2013

Jens Kappauf, Bernd Lauterbach and Matthias Koch, 2012, *Logistic Core Operations with SAP*, Springer.

Lebmollmann, Christoph, Presentation document of *Efficiency in Supply Chain Execution*, 2001.

Narayanan, A. Sankara, 2012, *QR Codes and Security Solutions, International Journal of Computer Science and Telecommunications*